CLAIMS

What is claimed is:

1. A cooling fan for an electronic device, comprising:

a three-phase DC motor; and

an impeller comprising a hub to house the three-phase DC motor and a plurality of blades extending from the hub, wherein each blade has a height that is at least 25 % of the impeller diameter.

2. The cooling fan as recited in claim 1, wherein each blade has a chord profile that increases in chord length from a region proximate to the hub to a maximum chord length at a defined blade height.

3. The cooling fan as recited in claim 2, wherein the defined blade height corresponding to the maximum chord length is approximately half the full blade height.

4. The cooling fan as recited in claim 2, wherein each blade of the impeller has a tip and the chord profile decreases in chord length from the blade height corresponding to the maximum chord length to the tip of the blade.

5. The cooling fan as recited in claim 2, wherein each blade has a tip and the stagger angle of each blade increases from the hub to the tip of the blade.

6. The cooling fan as recited in claim 5, wherein each blade has a stagger angle of approximately 29 degrees at the hub and a stagger angle of approximately 56 degrees at the tip.

7. The cooling fan as recited in claim 2, wherein each blade has a tip and a camber angle that decreases from the hub to the tip.

8. The cooling fan as recited in claim 6, wherein each blade has a camber angle of 26 degrees to 29 degrees at the hub and 9 degrees to 15 degrees at the tip.

9. The cooling fan as recited in claim 2, wherein each impeller has solidity of approximately one at the blade height corresponding to the maximum chord length.

10. The cooling fan as recited in claim 1, wherein the impeller has seven blades.

11. An electronic device, comprising:

a first cooling fan, comprising:

a motor; and

an impeller having a hub and a plurality of blades extending from the hub to a tip, wherein each blade has a chord profile that increases to a maximum chord length and decreases to a lesser chord length, a stagger angle that increases from the hub to the tip of the blade, and a camber angle that decreases from the hub to the tip.

12. The electronic device as recited in claim 11, wherein the impeller has a solidity of approximately one at the maximum chord length.

13. The electronic device as recited in claim 11, wherein the maximum chord length is located at approximately forty percent of the full blade height.

14. The electronic device as recited in claim 11, wherein each blade has a stagger angle of approximately 29 degrees at the hub and a stagger angle of approximately 56 degrees at the tip.

15. The electronic device as recited in claim 11, wherein each blade has a camber angle of approximately 29 degrees at the hub and approximately 12 degrees at the tip.

16. The electronic device as recited in claim 11, wherein the motor is a three-phase DC motor comprising a stator and a rotor comprising a rare earth magnet.

17. The electronic device as recited in claim 16, wherein the rare earth magnet comprises bonded neodymium-iron-boron.

18. The electronic device as recited in claim 11, comprising:

a second cooling fan in series with the first cooling fan, the second cooling fan comprising:

a motor; and

an impeller having a hub and a plurality of blades extending from the hub to a tip, wherein each blade has a chord profile that increases to a maximum chord length and decreases to a lesser chord length, a stagger angle that increases from the hub to the tip of the blade, and a camber angle that decreases from the hub to the tip.

19. The electronic device as recited in claim 11, comprising a bearing assembly operable to rotatably support the impeller, wherein the bearing assembly comprises a plurality of bearings each having an outer diameter at least three times the inner diameter.

20. A method of manufacturing a redundant cooling fan for an electrical device, comprising;

manufacturing each blade of the impeller to have an increasing chord profile from a base region of the blade to a maximum chord length at a specified blade height;

manufacturing each blade with a stagger angle that increases from the base region of the blade to the tip of each blade; and

manufacturing each blade with a camber angle that decreases from the base region of the blade to the tip.

21. The method as recited in claim 20, comprising manufacturing each blade of the impeller to have a decreasing chord profile from the maximum chord length to a lesser chord length at the blade tip.

22. The method as recited in claim 20, wherein manufacturing each blade with a stagger angle comprises manufacturing each blade with a stagger angle of approximately 29 degrees at the base region and a stagger angle of approximately 56 degrees at the blade tip.

23. The method as recited in claim 20, wherein establishing an impeller blade configuration comprises establishing each blade with a camber angle of approximately 29 degrees at the hub and approximately 12 degrees at the tip.

24. The method as recited in claim 20, comprising manufacturing the impeller with a solidity of approximately one at the maximum chord length.

25. A cooling fan comprising:

a motor;

an impeller coupled to the motor;

a fan housing to house the impeller; and

a finger guard secured to each end of the fan housing, the finger guard being displaced outward relative to the fan housing,

wherein the fan housing comprises a top that extends over each finger guard.

26. The cooling fan as recited in claim 25, wherein the motor comprises a three-phase DC motor.

27. The cooling fan as recited in claim 25, wherein the impeller comprises a hub and a plurality of blades extending from the hub to a tip, wherein each blade has a chord profile that increases to a maximum chord length and decreases to a lesser chord length, a stagger angle that increases from the hub to the tip of the blade, and a camber angle that decreases from the hub to the tip.

28. The cooling fan as recited in claim 25, wherein the impeller has a solidity of one at the blade height corresponding to the maximum chord length.